

Did you solve it? Would you get into Oxbridge?

The answers to today's puzzle. Find out if you made the grade

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Monday 7 November 2016 17.00 GMT

Earlier today I set you the following puzzle, from a recent Oxford Mathematics Admissions Test. Thanks to everyone who took part; more than a thousand comments below the line and several very funny threads.

And I'm very impressed - about 80 per cent of you got each question correct. Congratulations, you are all admitted into Oxford! (And next time I will make the questions more difficult.)

ADVERTISING

The question: Alice, Bob and Charlie are well-known expert logicians; they always tell the truth. They are sat in a row, as illustrated above. In each of the scenarios below, their father puts a red or blue hat on each of their heads. Alice can see Bob's and Charlie's hats, but not her own; Bob can see only Charlie's hat; Charlie can see none of the hats. All three of them are aware of this arrangement.

(i) Their father puts a hat on each of their heads and says: "Each of your hats is either red or blue. At least one of you has a red hat." Alice then says "I know the colour of my hat." What colour is each person's hat?

(ii) Their father puts a new hat on each of their heads and again says: "Each of your hats is either red or blue. At least one of you has a red hat." Alice then says "I don't know the colour of my hat." Bob then says "I don't know the colour of my hat." What colour is Charlie's hat?

(iii) Their father puts a new hat on each of their heads and says: "Each of your hats is either red or blue. At least one of you has a red hat, and at least one of you has a blue hat." Alice says "I know the colour of my hat." Bob then says "Mine is red." What colour is each person's hat?

(iv) *Their father puts a new hat on each of their heads and says: “Each of your hats is either red or blue. At least one of you has a red hat, and at least one of you has a blue hat.” Alice then says “I don’t know the colour of my hat.” Bob then says “My hat is red”. What colour is Charlie’s hat?*

(v) *Their father puts a new hat on each of their heads and says: “Each of your hats is either red or blue. Two of you who are seated adjacently both have red hats.” Alice then says “I don’t know the colour of my hat.” What colour is Charlie’s hat?*

Solutions

(i) Alice’s hat is red, and the others are blue. It must be that Alice can see that neither of the others has a red hat, so can deduce the colour of her own.

Charlie’s hat is blue. 83.2 per cent of you got it correct. 16.8 per cent got it wrong.

(ii) Alice must be able to see a red hat, or would be able to deduce the colour of her own hat. Likewise, Bob must be able to see a red hat, or would be able to deduce the colour of his own hat (given Alice’s answer). Hence Charlie’s hat is red.

Charlie’s hat is red. 74.1 per cent of you got it correct. 25.9 per cent got it wrong.

(iii) Alice must be able to see two hats of the same colour in order to deduce the colour of her hat. Bob knows this, and so deduces his hat is the same colour as Charlie’s. Hence Alice’s hat is blue, and Bob’s and Charlie’s are red.

Charlie’s hat is red. 78.8 per cent of you got it correct. 21.2 per cent got it wrong.

(iv) Alice must be able to see two hats of opposite colours, or else she would be able to deduce her own hat colour. Bob knows this, so deduces his hat is a different colour from Charlie’s. Hence Charlie’s hat is blue.

Charlie’s hat is blue. 89.2 per cent of you got it correct. 10.8 per cent got it wrong.

(v) If Bob and Charlie had different colour hats, Alice would know that she and Bob both had red hats. Therefore Bob and Charlie both have red hats.

Charlie’s hat is red. 82.7 per cent of you got it correct. 17.3 per cent got it wrong.

The question was Q6 from the 2012 Oxford Mathematics Admissions Test and was for applicants to Computer Science, Mathematics & Computer Science and Computer Science & Philosophy only.

I set a puzzle here every two weeks on a Monday. If you would like to suggest a puzzle email me.

My puzzle book Can You Solve My Problems? A Casebook of Ingenious, Perplexing and Totally Satisfying Puzzles is just out. It is an anthology of almost 200 puzzles - some of them similar to the hat puzzle above - together with stories about the people who invented them and background on the maths involved.

To get a third off the cover price, please go to bookshop.theguardian.com or call 0330 333 6846. Alternatively here’s a link to a well known web bookseller named after a river in Brazil.

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